MSDS 413, Summer 2019, Assignment 7
Volatility Models 2 (TS7)

Introduction

The monthly returns of the S&P composite index simple returns are in the file m-ba3dx6113.txt. The following list defines the variables:

- PERMNO: price end of period

- date: year month day (monthly data)

- ba: unused for this assignment

- vwretd: unused for this assignment

- ewretd: unused for this assignment

- sprtrn: simple returns

The log return of the daily exchange rate between Japanese Yen and U.S. Dollar from July 6, 2005 to April 18, 2014. The log return data are in the file d-fxjpus0514.txt.

Your objective is to explore the time series behavior of these data sets including EDA, modeling, model diagnostics, and interpretation.

Procedure

The following steps are necessary to complete this assignment. Address each and every part and ensure that you cover all the details specified in the questions.

1. **S&P** (3 points) Consider the monthly returns of the S&P composite index. The simple returns are in the file m-ba3dx6113.txt (column with heading sprtrn).

    1.1. Use EDA to justify a transformation of the simple returns to log returns. Use your analysis to select an appropriate model. Write the equation for this model.

    1.2. Find an adequate model for the monthly log return series. Perform model checking to justify your model.

    1.3. Obtain 1-step to 5-step ahead predictions of the log return and its volatility at the forecast origin December 2013.

    1.4. Fit a GJR model (using APARCH) to the monthly log return series. Write the model to be fitted. Is the leverage effect statistically significant? Why?

    1.5. Which model do you recommend and why?

2. **Exchange rate** (3 points) Consider the log return of daily exchange rate between Japanese Yen and U.S. Dollar from July 6, 2005 to April 18, 2014.

   2.1. Use EDA to show these data are stationary. Use your analysis to select an appropriate model. Write the equation for this model.

   2.2. Build a GARCH model (including mean equation) for the log return series. Perform model checking.

   2.3. Let r_t be the daily log return. For numeric stability, consider the percentage log return, i.e. $x_t = 100r_t$. Write the equation for the model to be fitted.

   2.4. Fit a volatility model with leverage effect to x_t. Is the leverage effect statistically significant? Why?

3. **Report** (1.5 points) Write an executive summary on your Exchange rate work . Use information upon which decisions or actions can be made.

Deliverables

See Section Submission Directions below. The assignment deliverables, each in pdf format, are as follows:

- *Only if requested by instructor*

  - The program or script
  - Logs
  - Outputs

- Mandatory
  Data analysis write-up: no programs, logs, or just code outputs.

The data analysis must follow and use the item numbering of each assignment, i.e., use the numbers, say, 1 - 5, with the sub-lettering if used. These deliverables are provided according to the instructions in the Submission Directions section below.

Submission Directions

Title Page

Include a title page with your name and the assignment designation. Leave room for instructor comments.

File Names

The assignment write-up file shall be submitted to Canvas according to the schedule in the syllabus using the item (1) naming convention below. The naming convention is case sensitive. Use letters and numbers as given. **The file name parts have no spaces or other separator charancters**. TS7Lastname.pdf (submit via Canvas)

The parts are the assignment code, TS7; your lastname with only the first letter capitalized; a period, and lastly, the extension "pdf". Generically,

TS7Lastname.pdf

For example: Suppose your name is Student McStats. Your filename then is:

TS7Mcstats.pdf

The analysis write-up file must be submitted for grading. Each write-up requires a title page for instructor comments. The analysis may use either R or any other statistics package you wish, or if you use more than one package, you must use the germane tables, plots, etc., in a single report. If you use more than one package, differences and similarities should be indicated.

email: jamie.riggs@northwestern.edu

Email *ONLY IF REQUESTED* the program (script), log and output as separate pdf files. The R log and output may be combined. The file names shall be as follows:

- The program or script file names
  - TS7LastnameRprog.pdf
- The log file names
  - TS7LastnameRlog.pdf